Wave-packet spreading in the disordered and nonlinear Su-Schrieffer-Heeger chain

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We discuss the connection between topological phases and long-time dynamics of initially localized wave-packets in one-dimensional disordered and nonlinear topological systems. Our model is a dimerized tight-binding lattice referred to as Su-Schrieffer-Heeger (SSH) chain [1]. This model is relevant in a variety of systems like optical waveguides [2], Bose-Einstein condensates (BECs) trapped in optical potentials [3] and synthetic momentum lattices [4]. We show that in the linear regime, as the parameters controlling the topology of the lattice are varied, the transition between two different topological phases is preceded by an anomalous diffusion of the wave-packet, in contrast to Anderson localization within these topological phases. In the presence of nonlinearity this feature is lost due to chaos and mode-mode interactions. We find that at weak and moderate strengths of nonlinearity a delocalization of the wave-packet takes place across the whole studied parameter space of the linearized model. Consequently, we underline the importance of the chaos and mode-mode interactions in nonlinear topological systems, which must be studied in order to define reliable nonlinear topological markers [5].

References

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